United States Patent [19]

Maier

[11] **3,923,227**

[45] **Dec. 2, 1975**

[54] **TAPERED SEAL BETWEEN THE BARREL AND DRUM TYPE MAGAZINE IN A FASTENING ELEMENT SETTING GUN**

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[22] Filed: **Dec. 10, 1974**

[21] Appl. No.: **531,444**

[30] **Foreign Application Priority Data**

Dec. 13, 1973 Germany 2362073

[52] **U.S. Cl.** **227/8;** 227/9

[51] **Int. Cl.²** **B25C 1/12**

[58] **Field of Search** 227/8, 9, 10, 11

[56] **References Cited**

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Attorney, Agent, or Firm—Toren, McGeady and Stanger

[57] **ABSTRACT**

In a setting gun for driving fastening elements into a receiving material, a barrel is axially displaceable into the bores in a rotatable drum type magazine for placing the gun in the firing condition. The rearward end of the bore in the barrel has a rearwardly divergent tapered surface arranged to seat in matching and contacting engagement with a similarly tapered surface within the bore of the magazine so that the joint between the two tapered surfaces extends in the rearward direction of the gun from the interior of the barrel bore. Further, the outer surface of the barrel at its rearward end is also tapered for matching engagement with a similarly tapered surface in the adjacent end of the bores in the drum type magazine.

6 Claims, 2 Drawing Figures

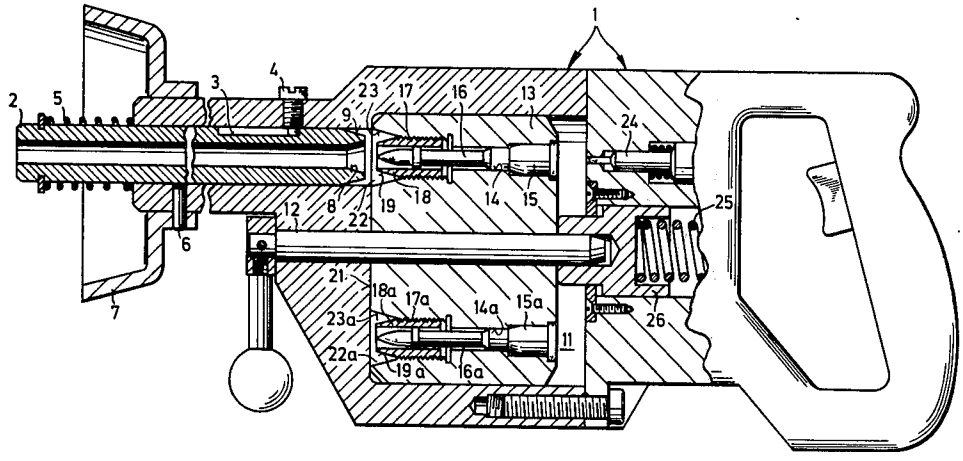
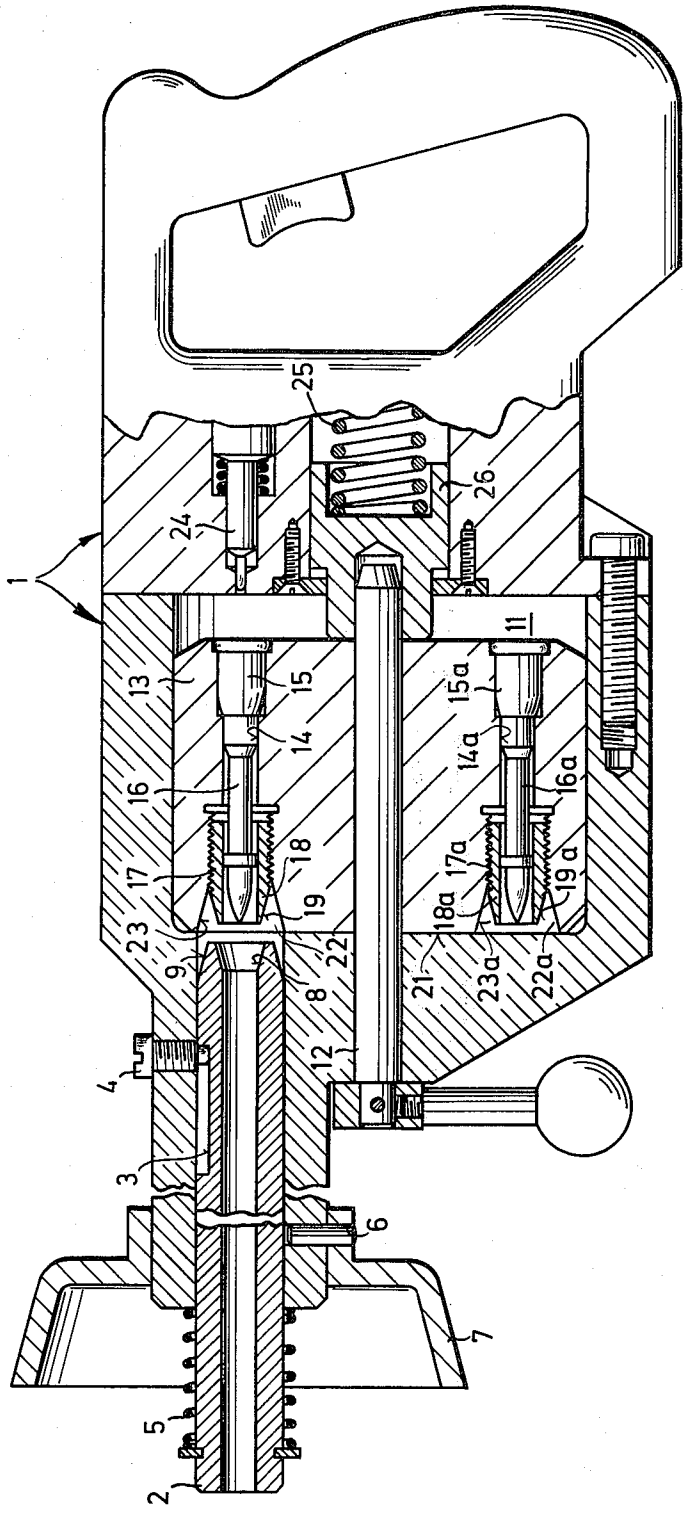


Fig. 1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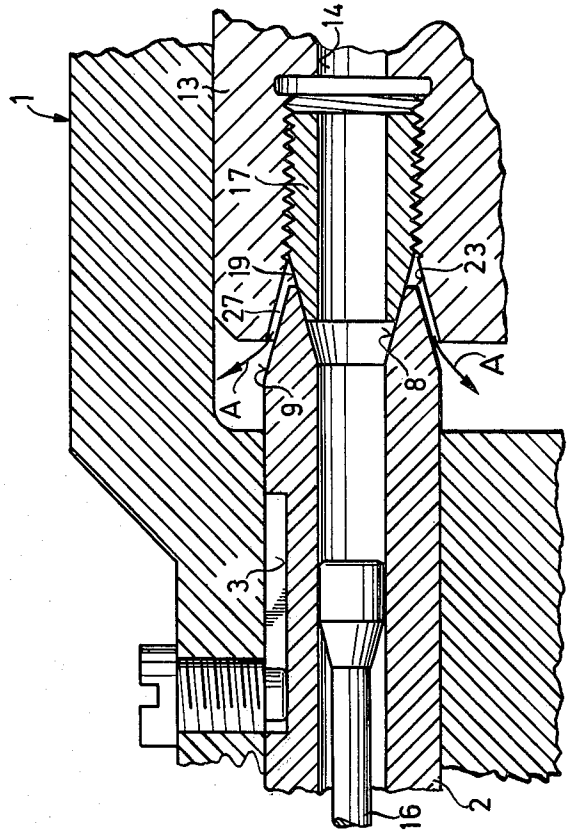

Fig. 2

TAPERED SEAL BETWEEN THE BARREL AND DRUM TYPE MAGAZINE IN A FASTENING ELEMENT SETTING GUN

SUMMARY OF THE INVENTION

The present invention is directed to an explosive charge driven setting gun for inserting fastening elements into a receiving material and includes an axially movable barrel displaceable into the firing position by moving it into one end of a bore in a drum type magazine and, more particularly, it concerns a tapered seal provided between the rear end of the barrel and the front end of the bore in the magazine.

Fastening element setting guns are known in which the end of the barrel tapers downwardly toward its rearward end. Further, in such setting guns using drum type magazines for accommodating the cartridges, the face of the magazine directed toward the barrel is provided with a countersunk portion having a taper which matches the one on the barrel. When the barrel is displaced rearwardly for placing the setting gun in the firing condition, the tapered surface on the barrel is disposed in contacting engagement with the countersunk tapered surface in the magazine. This abutting connection, in addition to providing a centering effect, affords a seal for the expansion chamber within the gun.

Experience has indicated that the seal provided by such an arrangement is inadequate because the joint formed between the contacting areas is oriented essentially in the flow direction of the expansion gases on the one hand and, on the other hand, when the barrel is replaced the taper on its outside surface is usually damaged, seriously detracting from its sealing ability. As a consequence, there is a considerable power loss, extensive contamination of the setting gun and an increase in the noise level generated by the gun.

Therefore, it is the primary object of the present invention to provide an effective seal between the barrel and drum type magazine in such a setting gun.

In accordance with the present invention, the problem previously experienced is overcome by providing a tapered surface within the bore in the barrel which converges in the driving direction of the gun and a matching tapered surface within the bore in the drum type magazine arranged to seat in contacting engagement with the tapered surface in the barrel when the barrel is displaced rearwardly into the firing position.

Due to the orientation of the tapered surfaces the direction of the joint between them runs in the opposite direction to the flow of the explosive gases within the barrel bore so that a substantially better seal is provided by their contacting areas. Furthermore, by providing the tapered surface within the bore of the barrel there is the advantage that it is protected against mechanical damage due to its location and thereby assures the required sealing action.

The tapered surface within the magazine bore is provided by the outer end surface of a bushing which is adjustably positionable within the bore so that it does not project beyond the front face of the magazine. This arrangement prevents the tapered end of the bushing from projecting into the barrel bore which would interfere with the rotation of the magazine for aligning another cartridge containing bore with the barrel.

Preferably, the inner surface of the magazine bore spaced outwardly from the bushing is enlarged for a portion of the bore extending from the front face of the drum type magazine. Where drum type magazines are used which must be removed from the setting gun for reloading, the bushings and their tapered surfaces are protected against possible mechanical injury.

Another advantage inherent in the arrangement of the outwardly facing tapered surfaces within the magazine bores is that the explosive gases escaping between the mutually tapered surfaces are abruptly deflected in the reverse direction and, therefore, are slowed down in passing through the gap between the rear end of the barrel and the tapered wall surfaces of the end of the magazine bore adjacent its front face. This arrangement affords a considerably improved sealing action.

It is particularly advantageous if the surface of the bores within the magazine taper outwardly in the driving direction and if the outer surface on the rear end of the barrel has a correspondingly tapered configuration so that the two surfaces are in matching contacting engagement when the barrel is moved rearwardly to the firing condition of the setting gun. This design eliminates any problems involved in precentering the barrel relative to the drum type magazine when the barrel is displaced into the firing position.

Another advantage of the arrangement provided by the present invention is the ability to adjust the space between the exterior of the barrel and the interior of the tapered surface of the bore in the magazine due to the axial adjustment of the bushing which is tapered on its outside surface to match the tapered surface in the interior of the bore of the barrel. Such adjustment can be provided in a particularly simple manner by placing the bushings in threaded engagement with the bore in the drum type magazine. Further, this arrangement also insures that the matching tapers on the interior of the barrel and in the bore of the drum type magazine reliably rest against each other in the firing condition of the gun so that the barrel is not supported by any other parts of the drum type magazine.

If the bushings used within the bores in the magazine are made of steel, the remainder of the magazine body may be formed of a lighter material such as an aluminum alloy. A noteworthy weight reduction can be obtained by such an arrangement as compared to the use of solid steel magazines. However, other materials can be used for the barrel and the bushing by which the sealing action as well as the wear on the barrel and the magazine can be influenced positively.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side view partly in section of an explosive charge driven setting gun; and

FIG. 2 is an enlarged partial view of the setting gun shown in FIG. 1 with the parts of the setting gun displaced into the firing condition.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. 1 the fastening element setting gun has a two-part housing 1. At the forward end of the setting gun a barrel 2 is axially movably positioned within the hous-

ing. To limit the extent of its axial movement, the barrel **2** has a flat or axially extending recess **3** in its outer surface into which a stop screw **4**, extending through the housing, is seated. A compression spring **5** is positioned about the forward end of the barrel for displacing it in the axial direction. At the forward end of the housing, a safety pin **6** secures a fragmentation protection cap **7** to the housing. At its rearward end within the housing, the barrel has a tapered surface **8** within the barrel bore and another tapered surface **9** on the outer surface of the barrel.

Immediately rearwardly of the rearward end of the barrel as shown in FIG. **1**, a chamber **11** is formed within the housing **1** to accommodate a drum type magazine **13** mounted on a shaft **12** so that the magazine is movable in the axial direction of the barrel. Angularly spaced bores **14**, **14***a* are provided in the drum type magazine each arranged to contain a cartridge **15**, **15***a* and a nail-shaped fastening element **16**, **16***a*, respectively. Axially positionable bushings **17**, **17***a* are disposed in threaded engagement with the surfaces in the forward ends of the magazine bores **14**, **14***a* respectively. The leading ends **18**, **18***a* of the bushings have a frusto conical configuration and are spaced radially inwardly from the juxtaposed surfaces of the magazine bore. The outside surface **19**, **19***a* of each of the forward bushing portions **18**, **18***a* has a tapered surface arranged to match the tapered surface **8** within the bore at the rearward end of the barrel **2**. On one hand, to prevent the forward portions **18**, **18***a* of the bushings from projecting forwardly of the front face **21** of the drum type magazine **13** and on the other hand, to make it possible for the rearward end of the barrel to seat over the forward portions **18**, **18***a* of the bushings **17**, **17***a*, annularly shaped open spaces **22**, **22** *a* are provided inwardly from the front face **21** of the magazine about the forward portions **18**, **18***a* of the bushings. The spaces **22**, **22***a* are provided by forming tapered surfaces **23**, **23***a* within the magazine bores diverging outwardly to the front face **21** of the magazine.

At the rearward end of the chamber **11**, in alignment with the axis of the barrel **2**, is a firing pin **24** for igniting the cartridges shown in the position of the cartridge **15**. The firing pin is part of a known firing mechanism and, therefore, has not been illustrated in detail. Within a recess in the rear part of the housing **1**, a spring **25** biases a pressure bushing **26** toward the forward end of the setting gun and the bushing also serves as a support for one end of the shaft **12** on which the drum type magazine is rotatably mounted. The spring **25** and bushing **26** bias the magazine **13** forwardly and keep it out of the range of the firing pin **24** when the setting gun is in the non-firing or inoperative condition.

When the barrel **2** is displaced rearwardly from the position shown in FIG. **1**, by being pressed against a receiving material, it is moved into the firing position with the tapered surface **8** within the bore of the barrel disposed in matching contact with the tapered surface **19** on the outer surface of the bushing so that a seal is provided between the two tapered surfaces, note FIG. **2**. The joint formed between the tapering surfaces **8** and **19** extends from the interior of the bore in the barrel rearwardly opposite to the normal direction of flow of the explosive gases within the barrel, that is, opposite to the driving direction of the setting gun. When the barrel is in the firing position it is placed relative to the drum type magazine **13** as shown in FIG. **2**. An annular gap **27** is formed between the outwardly facing tapered surface **9** on the rearward end of the barrel **2** and the inwardly facing tapered surface **23** within the magazine bore adjacent the forward face **21** of the magazine. Any gases which are generated when a cartridge is exploded and might possibly escape between the tapered surface **8** on the barrel and the tapered surface **19** on the bushing are abruptly deflected and slowed down by the annular gap **27** before leaving this part of the setting gun in the direction of the arrows A. The optimum size of the annular gap **27** is adjustable by moving the bushing axially within the magazine bore. However, the forward end of the bushing is retained rearwardly of the forward face **21** of the magazine **13** so that it does not interfere with the rotation of the magazine when a loaded bore is moved into alignment with the barrel bore after a cartridge has been fired.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

I claim:

1. In an explosive charge driven fastening element setting gun comprising a housing, a barrel with a bore therethrough having a forward muzzle end and an oppositely directed rearward end, and said barrel being axially displaceably mounted in said housing and movable rearwardly through said housing into the firing position, a drum type magazine mounted in said housing rearwardly of said barrel, said magazine having a forward face extending transversely of the axis of said barrel and facing toward the forward end of said barrel and a rearward face facing in the opposite direction, said magazine having bores therethrough extending in the axial direction of said barrel and arranged to align with said barrel, the rearward end of said barrel and the ends of said bores in said drum adjacent the forward face thereof each have matching tapered surfaces, wherein the improvement comprises that said matching tapered surfaces include a first tapering surface in the rearward end of the bore in said barrel and said first tapering surface diverging toward the rearward end of the barrel, and a second tapered surface formed within the bore in said magazine with said second tapered surface facing outwardly relative to the axis of the bore in the magazine and disposed inwardly from the surface forming the bore, said second tapered surface converging in the direction of the forward end of said barrel, said second tapered surface arranged in matching relationship with said first tapered surface so that said first and second tapered surfaces seat in substantially contacting engagement with one another when said barrel is displaced rearwardly into the firing position in one of the bores in said drum with the substantially contacting surfaces of said first and second tapered surfaces extending from the interior of the bore in said barrel in the direction away from the forward muzzle end of said barrel.

2. In an explosive charge driven fastening element setting gun, as set forth in claim **1**, wherein said second tapered surfaces are wholly located rearwardly of the forward face of said magazine.

3. In an explosive charge driven fastening element setting gun, as set forth in claim **2**, wherein the surfaces forming the bores in said drum extending from the forward face thereof have a third tapered surface converg-

ing inwardly for a part of the length of the bores toward the rearward face with the third tapered surfaces being spaced radially outwardly from said second tapered surfaces.

4. In an explosive charge driven fastening element setting gun, as set forth in claim **3**, wherein said barrel has a fourth tapered surface formed on the outer surface of said barrel at its rearward end with said fourth tapered surface converging in the direction away from the forward end of said barrel, said third tapered surface arranged in matching relationship with said fourth tapered surface so that it forms a narrow annular gap therebetween when said barrel is displaced rearwardly to the firing position.

5. In an explosive charge driven fastening element setting gun, as set forth in claim **2**, wherein a bushing is axially adjustably positionable within each of the bores in said drum adjacent the forward face of said drum, said second tapered surfaces being formed on the outer surfaces of said bushing at the ends thereof adjacent the forward face of said drum, said second tapered surfaces in each said bore being spaced radially inwardly from the third tapered surfaces formed by the surface of the bores.

6. In an explosive charge driven fastening element setting gun, as set forth in claim **5**, wherein the exterior surface of said bushings is threaded rearwardly of the second tapered surfaces for providing adjustable threaded engagement with the bores in said drum.

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